APPLICATION NOTE

GR/GS64 SIM Interface

Reference: **WI_DEV_Gx64_APN_013**

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Table of Contents

1 Introduction 4

1.1 NOTATION 4

1.2 ABBREVIATIONS 5

1.3 SIM TYPES 5

1.4 PIN CONNECTIVITY 6

2 Interfacing the SIM 7

2.1 INSERTION AND REMOVAL 7

2.2 SCHEMATIC CONSIDERATIONS 8

2.2.1 SIMVCC 9

2.2.2 SIMCLK 9

2.2.3 SIMDAT 10

3 Type Approval 11

3.1 ELECTRICAL TEST CASES 11

3.1.1 VCC 11

3.1.2 RST 11

3.1.3 CLK 11

3.1.4 IO 11

3.2 TEST CONNECTIONS 12

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1 Introduction

This application note introduces guidelines associated with the selection of components, design, and interfacing methods for a solution using the GR/GS64 line of Wireless CPUs. While it is not intended to be an exhaustive coverage of the topic of GSM SIM design, these guidelines provide factors that affect the versatility, final quality and ease of type approval of applications using one of the GR/GS64 Wireless CPUs.

1.1 Notation

The following symbols and admonition notation are used to draw the reader's attention to notable or crucially-important information.

Note
Draws the readers attention to pertinent, useful or interesting information

Tip
Provides advice, suggestions, guidance or recommendations which augment the formal text

Caution
Cautionary information must be heeded, it draws the readers attention to the need for understanding, care or watchfulness in relation to the information provided

Warning
Notes marked warning must be heeded, they alert readers to precautionary measures, risks, hazards or safety information which directly effects equipment function, warranty or personnel safety

Danger
This information must be heeded, it identifies information and cautionary behaviour that otherwise ignored could result in catastrophic equipment failure, bodily injury or death

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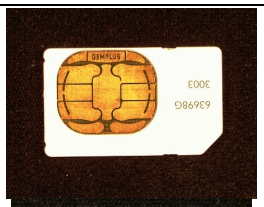
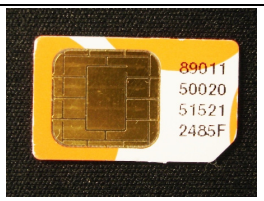
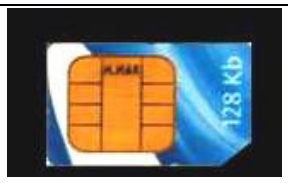
1.2 Abbreviations

Abbreviation	Description
EMC	Electro Magnetic Compatibility
SIM	Subscriber Identity Module

1.3 SIM Types

The table below gives a list of vendors for SIM-cards, their logotype and foot prints.

Vendor	Logotype	Connection pattern
Axalto	axalto your future in hand	
GEMPlus	GEMPLUS	
G&D	Giesecke & Devrient	
M-Systems	msystems	 Text says “M.MAR”

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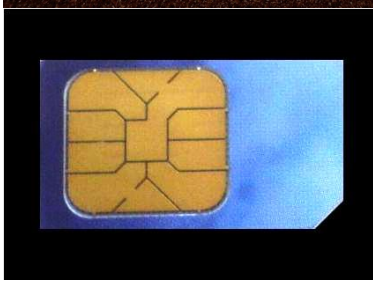
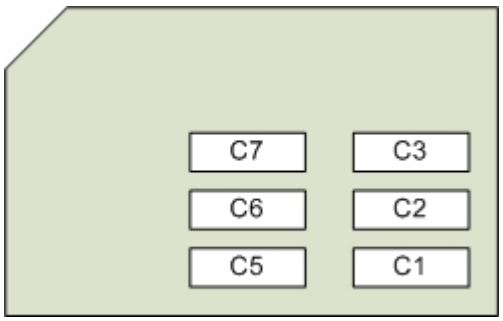
Vendor	Logotype	Connection pattern
Oberthur	Oberthur Card Systems	
ORGA	ORGA The Smart Card Integrator	

1.4 Pin Connectivity



- C1: VCC
- C2: RST
- C3: CLK
- C5: GND
- C6: VPP (Only used by service provider)
- C7: IO

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2 Interfacing the SIM

This section describes how to interface the SIM and lists things to look out for when it comes to component layout and routing. This is very important for type approval, since the required testing is very stringent.

2.1 Insertion and removal

The SIM should preferably be inserted and removed when the module is powered off.

CAUTION

Removing an active SIM can permanently damage the SIM.
Removing the SIM while data is transferred can cause the loss of data and in worst case permanently damage the SIM.

TIP

The SIMDET signal in the system connector can be used to indicate whether the SIM is going to be removed if it is linked to a mechanical lid covering the SIM-holder. The SIM can then safely be shut down before it is possible for the user to remove it from the holder.

TIP

The best solution for the SIM is if it is mounted in a location which requires the Wireless CPU to be powered off before accessing the SIM is possible. One option for this is behind the battery requiring the user to remove the battery before access to the SIM is provided.

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2.2 Schematic considerations

To make the design optimal and provide a flexible design for the type approval process it is beneficial to add optional components.

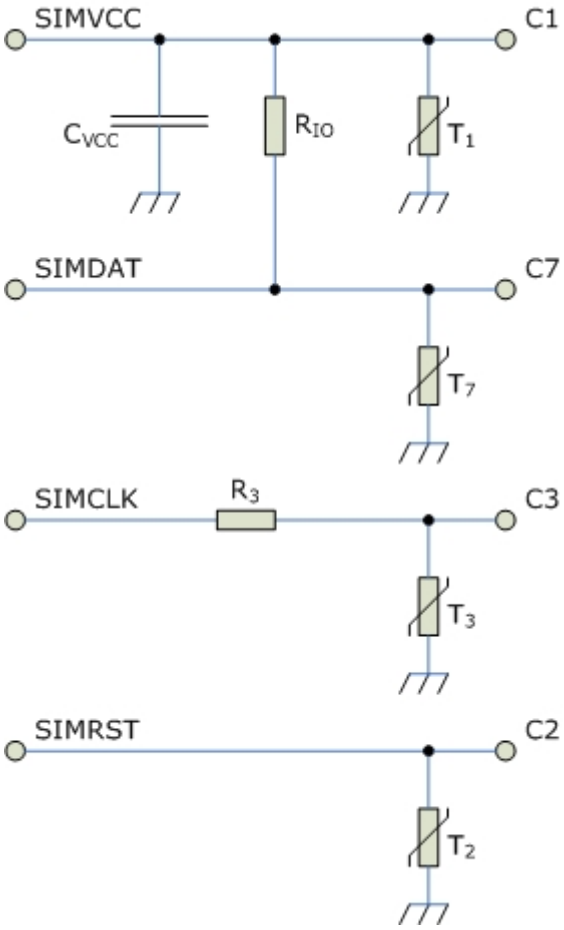

Figure 1: Recommended component provisions

Depending on the implementation transorbs might be needed to pass EMC-tests. It is important to realise that the inherent capacitance of the transorbs placed on SIMDAT and SIMCLK must be very low. The transorbs used on SIMVCC and SIMRST on the other hand can have very high inherent capacitance without causing a problem.

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2.2.1 SIMVCC

The SIMVCC-signal has a built-in 470nF capacitor inside the Wireless CPU. This capacitance might not be enough, and it might not add the capacitance where it is really needed. Provision for a capacitor (C_{VCC}) ranging between 1uF to 10uF or more should be made available as close to the SIM-holder as possible. This will enable easier type approval passing of the VCC and IO test cases (27.17.2.1).

TIP

Provide the capability of adding capacitance on SIMVCC as close to the SIM-holder as possible. The pad layout should support capacitors up to 10uF.

2.2.2 SIMCLK

The SIMCLK-line is a CMOS driver from the Wireless CPU to the application. In case the application adds inductance in the trace from SIMCLK of the system connector to C3 of the SIM-holder, the application might experience over and/or under shoot problems when running test cases (27.17.2.3). This can be taken care of by adding a series resistance as close to the system connector as possible. The resistor should be in the 10 ohm to 100 ohm range, but the required value might differ depending on the application implementation.

TIP

Provide the capability of adding an extra series resistor 10ohm to 100ohm close to the system connector to overcome possible over and/or under shoot problems.

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2.2.3 SIMDAT

The SIMDAT-line has a built-in 10k pull-up resistor implemented inside the Wireless CPU. This pull-up resistance might not be enough to pass the IO type approval test cases (27.17.2.5) depending on the application implementation. The application should provide the capability of adding a pull-up resistor (R_{IO}) from SIMDAT to SIMVCC as close to the SIM-holder C7-pin as possible. The resistor can be in the range from 6.8k and up. The resistance needed depends on the added capacitance from the system connector SIMDAT-pin to the C7-pin of the SIM-holder. The C_{VCC} capacitor added on SIMVCC will help alleviate this problem also.

CAUTION

The maximum current in the SIMDAT-line is limited to 1mA peak. If the current exceeds that, even for a very short time (ns range) the type approval test will fail. If this happens the R_{IO} value should be increased.

TIP

Provide the capability of adding capacitance on SIMVCC as close to the SIM-holder as possible. The pad layout should support capacitors up to 10uF.
Also provide the capability of adding an extra pull-up resistor ≥6.8k in case the application adds capacitance. This will improve the rise-time.

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3 Type Approval

3.1 Electrical test cases

The electrical test cases are specified in §27.17 of the ETSI 3GPP TS 51010-1 specification. The attached link points to the 51010-1 specification archive within ETSI.

(http://www.3gpp.org/ftp/Specs/archive/51_series/51.010-1/)

3.1.1 VCC

The SIM supply voltage is tested by the 27.17.2.1 e) test cases. If any of these test cases fail it is most likely due to too high impedance in the trace, causing the high voltage to go below minimum. This can be solved by adding a capacitor as close to the SIM-holder as possible (see 2.2.1 above).

3.1.2 RST

The RST signal is tested by the 27.17.2.2 e) test cases. These should not fail.

3.1.3 CLK

The CLK signal is tested by the 27.17.2.3 e) test cases. These tests could fail due to over and under shoot issues caused by trace inductance. This ringing can be limited by adding a small serial resistance close to the Wireless CPU system connector (see 2.2.2 above).

3.1.4 IO

The IO signal is tested by the 27.17.2.5 e) test cases. These tests could fail due to high capacitance caused by trace capacitance. This can be solved by adding a pull-up resistance to SIMVCC close to the SIM-holder (see 2.2.3 above).

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3.2 Test connections

The SIM type approval test equipment can be connected to the application in two different ways:

1. Paddle
2. Flying leads

The test facility will most likely perform all tests using the paddle. This is the most realistic and easiest way to test the device. This test method does have its draw-backs; the connections are worsened over time and if the paddle is not replaced every so often the test cases might start to cause false failures. If this occurs it is best to request that they use the flying lead method instead. This method entails the test equipment to solder down onto the SIM-holder leads (soldered onto the solder pads of the SIM-holder, not the pins on the holder that connects to the SIM-card). This method eliminates bad connection problems of the paddle method.

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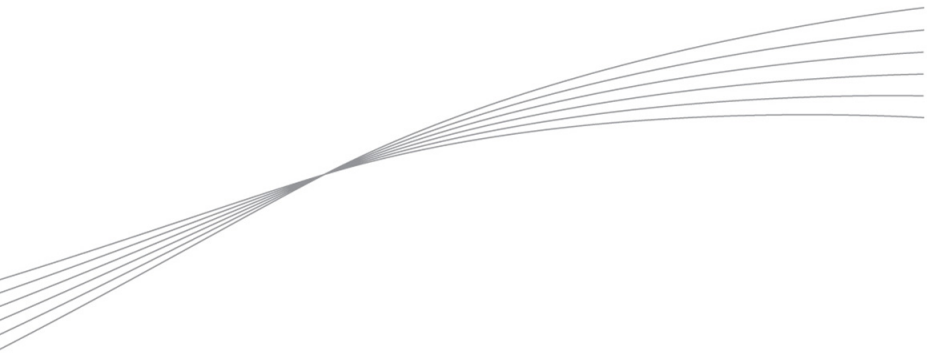

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WAVECOM S.A. - 3 esplanade du Foncet - 92442 Issy-les-Moulineaux Cedex - France - Tel: +33(0)1 46 29 08 00 - Fax: +33(0)1 46 29 08 08
Wavecom, Inc. - 430 Davis Dr. Suite 300 - Research Triangle Park, NC 27709 - USA - Tel: +1 919 237 4000 - Fax: +1 919 237 4140
WAVECOM Asia Pacific Ltd. - Unit 201-207, 2nd Floor - Bio-Informatics Centre - No. 2 Science Park West Avenue - Hong Kong Science Park, Shatin - New Territories, Hong Kong - Tel: +852 2824 0254 - Fax: +852 2824 0255